REMARKS

Claims 12-15, 17-22, 24-28 and 30-32 are pending in the present application. By this Response, claims 12, 17-19, 24, 26, 30 and 32 are amended and claims 16, 23 and 29 are canceled. Claim 12 is amended to recite "generating in a data processing system a hierarchical data structure in a primary storage." Claim 32 is amended to recite "generating in a data processing system a hierarchical mapping table in a primary storage subsystem." Support for these amendments may be found at least on page 2, lines 1-4. Claims 19 and 26 are amended and claims 12 and 32 are further amended to incorporate subject matter previously presented in claims 16, 23 and 29, now canceled. Claims 17, 18, 24 and 30 are amended for dependency in view of the cancellation of claims 16, 23 and 29. Reconsideration of the claims in view of the above amendments and the following remarks is respectfully requested.

I. 35 U.S.C. § 101

The Office Action rejects claims 12 and 32 under 35 U.S.C. § 101 as being directed towards non-statutory subject matter. Claim 12 is amended to recite generating in a data processing system a hierarchical data structure in a primary storage, which has a practical application and is in the technical arts. Similarly, claim 32 is amended to further define the generating in a data processing system a hierarchical mapping table in a primary storage subsystem, which has a practical application and is in the technical arts. Therefore, Applicants submit that independent claims 12 and 32 are statutory and Applicants respectfully request the withdrawal of the rejection of claims 12 and 32 under 35 U.S.C. § 101.

II. 35 U.S.C. § 102, Alleged Anticipation, Claims 12-15, 17-22, 24-28 and 30-32

The Office Action rejects claims 12-15, 17-22, 24-28 and 30-32 under 35 U.S.C. § 102(e) as being allegedly anticipated by Selkirk et al. (U.S. Patent No. 6,532,527). This rejection is respectfully traversed.

As to independent claims 12, 19, 26 and 32, the Office Action states:

Selkirk '527 discloses:

- generating a hierarchical data structure/table in a primary storage [e.g., Step 514, Fig. 5; Fig. 8; col. 3, lines 40-42; col. 10, lines 35-40];
- the hierarchical data structure includes a plurality of layers arranged according to a hierarchy [e.g., col. 10, lines 38-51];
- each data entry in each layer represents a range of the virtual address [e.g., Fig. 5, 7, 9 & 10];
- each data entry is correlated to a set of data entries in the next lowest layer [e.g., col. 10, lines 52- col. 11, line 5];
- each data entry in the lowest layer corresponds to both a virtual address range and a block address corresponding the a physical data block in the at least one data storage device [e.g., col. 11, lines 6-34, Figs. 9-10];
- each data entry within the primary storage corresponds to a currently occupied virtual address range, such that none of the data entries corresponds to only unused physical storage [see the erase gap processing, col. 12, lines 5-26];
- each physical data block in the at least one data storage device contains virtual address information that identifiers at least one corresponding location in the virtual address space for that physical data block [e.g., see the Hash algorithm to map a virtual address space for a physical storage data block; col. 11, lines 35-48].

Office Action dated January 2, 2004, pages 5-6.

Claim 12, which is representative of the other rejected independent claims 19, 26 and 32 with regard to similarly recited subject matter, reads as follows:

12. A method for mapping a virtual address space into block addresses of at least one data storage device, the method comprising:

generating in a data processing system a hierarchical data structure in a primary storage;

wherein the hierarchical data structure includes a plurality of layers arranged according to a hierarchy;

wherein the plurality of layers include at least a highest layer and a lowest layer;

wherein each layer in the hierarchical data structure includes at least one set of data entries;

wherein each data entry in each layer represents a range of the virtual address space;

wherein for each layer in the hierarchical data structure for which there exists an next lowest layer, each data entry is correlated to a set of data entries in the next lowest layer according to a correlation scheme;

wherein each data entry in the lowest layer corresponds to both a virtual address range in the virtual address space and a block address corresponding to a physical data block in the at least one data storage device;

wherein each data entry contained within the primary storage corresponds to a virtual address range that is currently occupied with stored data, such that none of the data entries corresponds to only unused physical storage;

wherein each physical data block in the at least one data storage device contains virtual address information that identifies at least one corresponding location in the virtual address space for that physical data block; and

wherein at least some of the data entries in each layer represent virtual address ranges of a homogeneous size corresponding to that layer.

A prior art reference anticipates the claimed invention under 35 U.S.C. § 102 only if every element of a claimed invention is identically shown in that single reference, arranged as they are in the claims. In re Bond, 910 F.2d 831, 832, 15 U.S.P.Q.2d 1566, 1567 (Fed. Cir. 1990). All limitations of the claimed invention must be considered when determining patentability. In re Lowry, 32 F.3d 1579, 1582, 32 U.S.P.Q.2d 1031, 1034 (Fed. Cir. 1994). Anticipation focuses on whether a claim reads on the product or process a prior art reference discloses, not on what the reference broadly teaches. Kalman v. Kimberly-Clark Corp., 713 F.2d 760, 218 U.S.P.Q. 781 (Fed. Cir. 1983). Applicants respectfully submit that Selkirk '527 does not identically show each and every feature of the claims arranged as they are in the claims. Specifically, Selkirk '527 does not teach where at least some of the data entries in each layer represent virtual address ranges of a homogeneous size corresponding to that layer.

Selkirk '527 is directed to a method for using existing internal mapping mechanisms to dynamically map data in a computer storage subsystem. The Selkirk '527 invention uses a dynamic mapping mechanism to mark a data location and then uses pointers to direct write requests for the data location to a side file. The new data is then written in the side file and a housekeeping operation reconciles the old and new data locations.

While Selkirk '527 may map data, there is nothing in any section of Selkirk '527 that teaches where at least some of the data entries in each layer represent virtual address ranges of a homogeneous size corresponding to that layer. The Office Action alleges

that this feature is taught by Selkirk '527 at Figure 9 and the related description, specifically element 906, which are reproduced as follows:

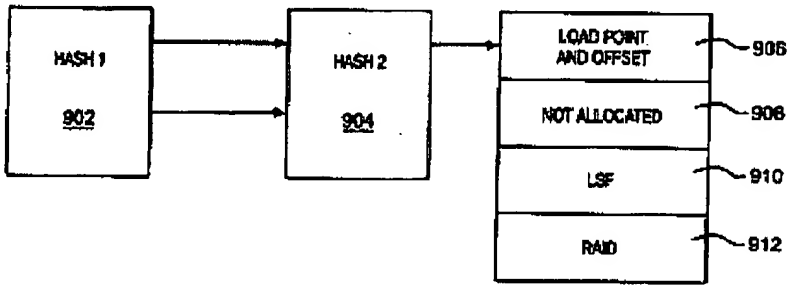

FIG. 9

> FIG. 9 is an exemplary diagram of a portion of a mapping table describing an address range with four distinct sections in accordance with a preferred embodiment of the present invention. Hashing algorithms are a well known mechanism for storage subsystems to manage space and resolve an input address to a physical storage location. Hash algorithm 1 902 and hash algorithm 2 904 are serially implemented algorithms that may be used in a storage subsystem by a processor, such as processors 210-224 in FIG. 2. Hash 2 algorithm 904 may resolve to several sections. Each section may in turn be mapped using different mapping techniques, such as, for example, load point and offset section 906, not allocated section 908 logged structured file (LSF) section 910 and RAID section 912.

(Column 11, lines 35-48)

In this figure and section, with respect to element 906, Selkirk '527 is merely describing that the load point and offset section may be mapped by the Hash 2 algorithm that may be used to resolve different sections. Nowhere in this section, or any other section of Selkirk '527, is the load point and offset section represented as a layer, much less representing virtual address ranges of a homogeneous size corresponding to a layer. The Selkirk '527 invention uses a dynamic mapping mechanism to mark, via a D-Mark, a data location and then using pointers to direct write requests for the data location to a side file. Selkirk '527 is not concerned with whether data entries in each layer represent virtual address ranges of a homogeneous size corresponding to that layer.

Thus, Selkirk '527 does not teach each and every feature of independent claims 12, 19, 26 and 32 as is required under 35 U.S.C. § 102. At least by virtue of their dependency on independent claims 12, 19 and 26, Selkirk '527 does not teach each and every feature of dependent claims 13-15, 17, 18, 20-22, 24, 25, 27, 28, 30 and 31. Accordingly, Applicants respectfully request withdrawal of the rejection of claims 13-15, 17, 18, 20-22, 24, 25, 27, 28, 30 and 31 under 35 U.S.C. § 102.

Furthermore, Selkirk '527 does not teach, suggest, or give any incentive to make the needed changes to reach the presently claimed invention. Absent the Examiner pointing out some teaching or incentive to implement Selkirk '527 such that data entries in each layer represent virtual address ranges of a homogeneous size corresponding to that layer, one of ordinary skill in the art would not be led to modify Selkirk '527 to reach the present invention when the reference is examined as a whole. Absent some teaching, suggestion, or incentive to modify Selkirk '527 in this manner, the presently claimed invention can be reached only through an improper use of hindsight using the Applicants' disclosure as a template to make the necessary changes to reach the claimed invention.

Moreover, in addition to their dependency from independent claims 12, 19 and 26, Selkirk '527 does not teach the specific features recited in dependent claims 13-15, 17, 18, 20-22, 24, 25, 27, 28, 30 and 31. For example, with regard to claims 17, 24 and 30, Selkirk '527 does not teach generating a second data structure, wherein the second data structure identifies exceptional data entries in the hierarchical data structure, wherein each individual exception data entry corresponds to a virtual address range a size that differs from the homogeneous size corresponding to that layer to which the individual exceptional data entry belongs. The Office Action alleges that this feature is taught at column 10, lines 9-16 and lines 29-34, which reads as follows:

> The boundary information may include, for example, description of size of data units mapped, a description for a like set of entries, a unique description for each entry, a specified default size for a set of entries, including exception flags for modified entries and a bit map. The description of the size of the data units mapped may be by way of a pointer with an address range or a pointer with a unit size.

(Column 10, lines 9-16)

> Boundary information may consist of, for example, fixed mapping wherein every entry in the table has the same extent and location which

> may be computed, variable mapping in which every entry in the table is unique and default variable in which there is a default extent size and a map of which entries are exceptions.

(Column 10, lines 29-34)

While these sections of Selkirk '527 may teach that the boundary information may contain information pertaining to size of data units mapped, a description for a like set of entries, a unique description for each entry, a specified default size for a set of entries, including exception flags for modified entries and a bit map and that the boundary information may be of a fixed or variable mapping type, there is nothing in these sections, or any other section of Selkirk '527 that identifies a homogeneous size corresponding to that layer to which the individual exceptional data entry belongs and generates a second data structure, wherein the second data structure identifies exceptional data entries in the hierarchical data structure, wherein each individual exception data entry corresponds to a virtual address range a size that differs from the homogeneous size corresponding to that layer to which the individual exceptional data entry belongs, as recited in claims 17, 24 and 30.

Therefore, in addition to being dependent on independent claims 12, 19 and 26, respectively, dependent claims 13-15, 17, 18, 20-22, 24, 25, 27, 28, 30 and 31 are also distinguishable over Selkirk '527 by virtue of the specific features recited in these claims. Accordingly, Applicants respectfully request withdrawal of the rejection of claims 13-15, 17, 18, 20-22, 24, 25, 27, 28, 30 and 31 under 35 U.S.C. § 102.

III. Conclusion

It is respectfully urged that the subject application is patentable over the prior art of record and is now in condition for allowance. The Examiner is invited to call the undersigned at the below-listed telephone number if in the opinion of the Examiner such a telephone conference would expedite or aid the prosecution and examination of this application.

Respectfully submitted,

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